nous fed hens laid more than three times as many eggs, that a nitrogenous ration stimulates egg-production.

On Nov. 27 the fowls were slaughtered. Each fowl was weighed, wrapped in a bag to prevent floundering, and killed by severing an artery in the roof of the mouth. The blood was caught in a glass jar. The fowls were then picked and the feathers weighed, after which the body was laid open longitudinally by cutting alongside the sternum and through the backbone. When all had been thus prepared, they were hung up in groups to be photographed, but the photographs were quite unsatisfactory so far as showing the relative proportions of fat and lean.

One half of each fowl was tested by cooking for flavor, succulence, and tenderness: the other half was carefully prepared for chemical analysis by separating the meat from the bones. The flesh was thoroughly mixed and run through a sausage-cutter, mixed again, and the process repeated three times. From different parts of this mixture a large sample was taken, from which the chemist took his samples for analysis. The right tibia of each fowl was tested for strength by placing it across two parallel bars and suspending a wire on its centre on which were placed small weights until the bone gave way.

Dressed Weight, Internal Organs, etc.

	HENS.		CHICKENS.	
	Lot I. Nitrogenous.	Lot II. Carbonaceous.	Lot I. Nitrogenous.	Lot II. Carbonaceous.
Live weight, pounds	21.31	22.00	17.89	12.63
Dressed weight, pounds	14.86	15.09	12.01	8.89
Dressed weight per hundredweight, pounds	69 70	68.60	67.10	70.50
Weight of blood, pounds	.75	.66	.55	.34
Weight of feathers, pounds	1.41	1 25	1.28	.66
Weight of intestinal fat, pounds	.59	1.98	.34	.66
Weight of offal, pounds	3.70	3.02	3.62	2.08
Weight of bones, pounds	3.47	3.63	3.18	2.69
Weight of flesh, pounds	11.39	11.47	8.93	6.20

The breaking strain of the right tibia was as follows for the hens and chickens of the various lots: —

Average, hens, nitrogenous	48.16
Average, hens, carbonaceous	51.74
Average, chickens, nitrogenous	46.64
Average, chickens, carbonaceous	31.18

There was little difference in the strength of the bones of the hens, undoubtedly because the bones were mature before the feeding began, and were little affected by the feeding. We find, however, that the bones of the chickens fed on nitrogenous food were almost fifty per cent (49.6) stronger than those fed carbonaceous food.

The flesh of each group was submitted to a number of persons for a cooking test, and the almost unanimous verdict was that the flesh of the fowls fed a nitrogenous ration was darker colored, more succulent, more tender, and better flavored, though on this last there was some difference of opinion.

So far as it is warrantable to draw any conclusions from a single experiment of this kind, it would seem that chickens fed on an exclusive corn diet will not make a satisfactory development, particularly of feathers; that the bones of chickens fed upon a nitrogenous ration are fifty per cent stronger than those fed upon a carbonaceous ration; that hens fed on a nitrogenous ration lay many more eggs, but of smaller size and poorer quality, than those fed exclusively on corn; that hens fed on corn, while not suffering in general health, become sluggish, deposit large masses of fat on the internal organs, and lay a few eggs of large size and excellent quality; and that the flesh of nitrogenous fed fowls contains more albuminoids and less fat than those fed on a carbonaceous ration, and is darker colored, juicier, and tenderer.

FEEDING STEERS OF DIFFERENT BREEDS.

IN Bulletin No. 69 of the Michigan Agricultural Experiment Station Mr. Eugene Davenport, agriculturist of the station, remarks that it has long been known that other influences than food operated decidedly to affect the gains of a feeding animal. The individual variation is great, often if not always easy to foresee, but impossible to estimate, hence the benefit of selection; and every feeder knows that as much depends upon the selection of the bunch of feeders as upon their after-care.

The question has arisen in the minds of men, whether or not, by the various standards of selection employed in the establishment of breeds, any important differences have resulted; and whether or not, properly speaking, there are such things as breed differences aside from form, color, etc.; and, if so, what are their character and extent? Are they sufficient to distinguish one breed above another?

This question was made the basis of two extended feeding experiments by the Michigan Station with steers of different breeds. The first is reported in full in Bulletin No. 44, and the second forms the subject of Bulletin No. 69.

Though primarily conducted as an experiment between the breeds, Mr. Davenport prefers to present the records and data independent of that question, — to discuss it in other bearings as well, and discover, if possible, what other circumstances may have exerted influences upon the gains, retaining till the close of the discussion the question of the breeds.

The influence of different kinds of feed-stuffs has not entered into this experiment. The idea has been to feed them alike, using a mixed grain diet, and giving some variety both in grain and coarse fodder, and to adjust the amount of both at all times to the appetite of the individual animal. The rations of all the steers have been at all times precisely alike, except as to amount and some slight variations which they established themselves between grain and coarse fodder.

Every opportunity possible has been afforded, regardless of expense, for individual differences and breed peculiarities to appear.

Neither this nor any similar experiment is absoutely just to all the breeds. The conditions have been made alike for all, except as to the amount of food each chose to take. But like conditions cannot be taken as being equally favorable to all. The framing of an experiment which should afford each its best conditions would include those so dissimilar as to make the results not capable of comparison. Likely this is as well as could be done, though it certainly affords conditions more nearly natural to some than to others. There is no doubt, that if they had been kept in open yards, with a higher proportion of coarse fodder, the results would have been greatly different, both absolutely and relatively. The whole experiment may be taken as one employing a heavy grain ration, for the bunch consumed as many pounds of grain as of coarse fodder if the latter had been equally dry.

The plan was to secure as nearly typical specimens of the breeds as possible. There were originally two each of the five breeds, Galloway, Holstein, Hereford, Short-Horn, and Devon, but accidents deprived the station of one of the Short Horns and one of the Devons.

It is not thought that either breed suffered in the loss. It is to be regretted, but it is not always possible to carry ten animals for two years and a half and all remain in every way normal. This is mentioned lest the experiment be criticised for furnishing only one specimen of these two breeds. This loss is to be regretted, for even the two is too small a number to estimate their personal equation; and not till after that is done can any difference in breeds be fully established.

The grain ration was made up of corn and oats (either whole or

ground), with bran and some preparation of oil-meal. The proportions varied from time to time, but was always the same for all the animals. No molasses was used, nor condiments of any sort.

The coarse fodder was principally mixed hay (timothy and clover), relieved by roots (mangels, turnips, etc.), corn-ensilage, cut grass or corn, and in the early part by pasture. During the first summer they were on pasture a large part of the time for about four months, too long for their best good. The last summer they were out from May 17 to June 6, and rested from grain. This resulted in a temporary loss of weight, but a real advantage to the steers.

The results of this experiment seem strongly to confirm the following: —

1. The amount of food consumed is no index of the amount of gain it will produce; that is, to its profitable use and conversion into meat.

2. Neither is the total gain secured, nor the rate of gain, a sure guide to the economical use of food by the animal.

3. Large gains are not necessarily economical ones, nor medium ones necessarily costly.

4. Age is the all-controlling circumstance that decides the rate of gain. The ration necessary to sustain the gain increases with age in about the same proportion as the weight of the animal, but the gain remains absolutely about the same.

5. That "baby beef" is not inconsistent with high quality.

6. That nervousness is not necessarily a sign of a bad feeder.

7. That great development in size is not a necessary condition to profitable feeding nor to quality.

8. That the "type" of an animal has much to do with his ability to use food to good advantage in the production of meat. In this sense there is a distinction and a difference between the breeds for beef purposes.

9. Those nearest the "dairy type" made less gain to the food consumed, and it consisted more largely of fat on and about the internal organs. This type was also characterized by coarser extremities; a longer, flatter rib; more shrinkage of meat in cooling; and a higher percentage of cheap parts.

10. As between the beef breeds, Mr. Davenport thinks no one can here suggest marked differences that cannot be sufficiently explained on other grounds. As in all experiments of this kind, greater differences are noticeable within the breeds than between them. The two Herefords are in this experiment nearly at extremes in every thing but type, and in that respect as far apart as is allowable among Herefords. Aside from the Holsteins, no two animals of the lot differed more than did the two Herefords. Very close upon them came the two Galloways, with marked differences in build.

11. Knowing these animals as he did, Mr. Davenport thinks he may safely say, that as they, irrespective of breed, approached a certain stocky, blocky form, designated as the "meat type," in the same degree they proved good feeders and economical consumers of food within a reasonable age. On the other hand, as they approached the coarser or more loosely built organization, betraying a circulation more largely internal and less diffused, in about the same proportions were they less profitable consumers of food for meat purposes, and turned out a less desirable carcass for the block. If this be true, it is a question of type rather than of breed; and that breed that affords the largest proportion in members of this type is, all things considered, the best, if any one thinks he knows which breed or breeds that may be.

In saying this, Mr. Davenport believes that he only follows the teachings of this and all other experiments. Nor does it work any injustice to other types selected for and excelling in other special lines. All will make some beef. Only a few will make the best or the cheapest. The strong teaching in this is, that moderate gains are not inconsistent with profit, nor lack of age inconsistent with quality.

An experiment of this kind is attended with much expense and labor. Many a careful thought and laborious hour go to secure what passes into a few tables. If only it shall assist a little in the establishment of knowledge and of truth, and not at all in fostering an error, then every one will be well paid.

OUTLINE OF THE HISTORY OF COMMERCIAL FERTILIZERS.[1]

THE history of commercial fertilizers practically dates back to the time when bones were first applied to the soil, and their value as a fertilizer was recognized. Fertilizing with bones was first practised in England. Probably the first instance of their extensive application was in the case of the farmers living near Sheffield, England, who applied to the land the bone and ivory clippings which were waste products of the knife and button factories of Sheffield. These clippings amounted to about eight hundred tons a year, and were regarded, until about a century ago, as a nuisance, the disposal of which was a serious problem to the manufacturers.

In 1774 the agricultural use of bones was first publicly recommended by Hunter, and successful experiments were made with bone-dust.

About 1814, Alexander von Humboldt called public attention to the use of guano as a fertilizer, which he had seen used by the natives of Peru.

About 1817 the first super-phosphate is believed to have been made by Sir James Murray.

It was not until after 1820 that the use of phosphates assumed any great commercial or agricultural importance, and not even then was it appreciated what gave bones their value as fertilizers.

About 1830, Peruvian guano began to be imported into Europe as a fertilizer, and, a few years after, into the United States, especially at the South.

About 1840, Liebig published the results of his researches, and suggested that plants must obtain materials for their growth from the soil as well as from the air and water, which alone were previously supposed to furnish plant-food, and hence that the proper life of a plant can be benefited by furnishing those elements that are necessary. It was shown that the phosphate of lime in bones gave them their value, and that by dissolving bones with sulphuric acid they were made much more effective. The demand for bones then outran the supply. Other sources were looked for, and in 1843 a new source of phosphate of lime was found in Spain, consisting of a rock which contained considerable amounts of phosphoric acid. On trial, this rock was found to be a substitute for bone.

In the United States, farmers first used bones about 1790. The first bone-mill was built about 1830, and super-phosphates were first used in 1851. The discovery of the so-called South Carolina rock was a great boon to those using commercial fertilizers, as this was found to take the place of bones.

The investigations based upon Liebig's theory showed that other elements in addition to phosphorus must be used to secure the best results, and gradually commercial fertilizers containing other elements came to be manufactured and offered for sale.

LETTERS TO THE EDITOR.

Ohio State University.

BY the recent passage of the Hysell Bill in the Ohio Legislature, which levies a tax of one-twentieth of a mill on every dollar of taxable property in the State, some attention has been turned toward this institution.

The institution was founded in 1862. At that time the State received from the United States 630,000 acres of land; and now the fund from the sale of this land is nearly $540,000, and yields an income of over $32,000.

The legislature has made liberal appropriations from time to time, but the trustees and faculty have hesitated to lay out very extensive plans, for this support was not entirely sure; but, now that this can be depended upon, plans for increasing the facilities of the institution will be carefully considered. The tax will bring the university $90,000 each year, which, together with what it receives from other sources, places Ohio on her feet in the educational race; and she will soon be in advance of her weaker sisters,

[1] From Bulletin No. 26 of the New York Agricultural Experiment Station.